

Claims:

1. Machine tools which have for the in particular cutting machining of workpieces several tool spindles, a tool magazine serving for supplying and changing of tools, the one tool magazine serving for changing the tools of at least two machining spindles, **characterised in that** at least a part of the supplied tools (31) and the tools (31) which have to be changed are arranged at the same plane (410).
2. Machine tools according to claim 1, **characterised in that** a connection line between the machining spindles (3) is part of the plane (410).
3. Machine tools according to claim 1, **characterised in that** the plane (410) for arranging the tools (31) in the tool magazine (4) is orientated essentially vertically.
4. Machine tools according to claim 1, **characterised in that** the plane (410) for the arrangement of the tools (31) in the tool magazine (4) is orientated essentially horizontally.
5. Machine tools according to claim 1, **characterised in that** the tool magazine (4) changes simultaneously the tool at several, at least two, tool spindles.
6. Machine tools according to claim 1, **characterised in that** the tool magazine (4) is designed as chain magazine (45) and the chain can circulate endlessly and the chain carries tool tongs (46) for picking up the tools (31).
7. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on

its outside tool tongs (46) for picking up the tools (31).

8. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and that the disc (47) is designed ring-shaped.
9. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the disc (47) is designed on its outside circular or polygonal.
10. Machine tools according to claim 1, **characterised in that** the tool magazine (4) is designed as chain magazine (45) and the chain can circulate endlessly and the circulating chain of the chain magazine (45) determines the plane.
11. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the disc (47) determines the plane.
12. Machine tools according to claim 1, **characterised in that** the spindle axis (30) of the machining spindle (3) is orientated parallel or angled, in particular rectangular to the plane (410).
13. Machine tools according to claim 1, **characterised in that** the tool axis, in particular the axis of symmetry or rotational axis, of the tool (31) supplied in the tool magazine (4) is orientated parallel or angled, in particular rectangular to the plane (410).

14. Machine tool according to claim 1, **characterised in that** the tool magazine (4) has a receiver (48) which can be connected with a supporting beam (10), the chain, respectively the disc (47), being movable towards the receiver.
15. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a receiver (48) which can be connected with a supporting beam (10), the chain, respectively the disc (47), being movable towards the receiver, and on the receiver (48) a drive (49) for the tool magazine (4), in particular a chain drive or a rotational drive, for the disc (47) is provided.
16. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the ring-shaped disc (47) has on its inside (400) a toothed ring and the toothed ring co-operates with a pinion of the rotational drive (49).
17. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the distance of the tongs (46) corresponds with the distance of the machining spindles, if necessary also the machining spindles of different machining units.
18. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the distance of the machining spindles (3) is an integral multiple of the tongs distance.
19. Machine tools according to claim 1, **characterised in that** the distance of the machining spindles (3) can be varied.

20. Machine tools according to claim 1, **characterised in that** the distance of the machining spindles (3) is varied during the machining and/or during the workpiece change.
21. Machine tools according to claim 1, **characterised in that** the distance of the machining spindles (3) can be varied during the machining and the machining spindles can be brought into a tool change distance for the tool change.
22. Machine tools according to claim 1, **characterised in that** an adjustment drive is provided, by means of which the distance of the machining spindles (3) can be set.
23. Machine tools according to claim 1, **characterised in that** the machining spindles (3) of at least one machining unit are supported by one or more guide(s) in such a way that the distance between the machining spindles (3) can be altered.
24. Machine tools according to claim 1, **characterised in that** the machine tools have a workpiece carrier for receiving the workpiece(s) wherein the workpiece carrier carries one, two or more, if necessary, uniform or different workpieces.
25. Machine tools according to claim 1, **characterised in that** the machine tools have two machining spindles (3) which are arranged with reference to a center plane symmetrically in the machine tools.
26. Machine tools according to claim 1, **characterised in that** the machining spindles (3) each have their own drives (32) independent from each other by means of which the distance between the machining spindles can be altered.

27. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the distance of the tongs (46) can be varied.
28. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the tongs (46) are supported movably in a linear guide (402) and a tongs adjustment drive (401) changes the distances of the tongs (46) to each other.
29. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the tongs (46) are supported movably in a linear guide (402) and a tongs adjustment drive (401) changes the distance of the tongs (46) to each other and the tongs adjustment drive (401) is formed by a threaded drive which acts on all tongs (46).
30. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the tongs (46) are supported movably in a linear guide (402) and a tongs adjustment drive (401) changes the distance of the tongs (46) to each other and the tongs adjustment drive (401) is formed by a threaded drive acting on all tongs (46) and the thread pitch on the threaded drive (401) for the tongs (46) each is different.
31. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on

its outside tool tongs (46) for picking up the tools (31) and the tongs (46) are supported movably in a linear guide (402) and a tongs adjustment drive (401) changes the distance of the tongs (46) to each other and the tongs adjustment drive (401) is formed by a treaded drive which acts on all tongs (46) and the direction of the thread on the threaded drive (401) for the tongs (46) each is different.

32. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and on the circumference of the disc (47) alternately each with at least to sets of tongs with k tongs each are provided and the tongs of a tongs set (6, 60) each are located on a tongs line (61, 62).

33. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and on the circumference of the disc (47) alternately each with at least two tongs sets with k tongs each are provided and the tongs of a tongs set (6, 60) are located on a tongs line (61, 62) and the tongs lines (61, 62) of different tongs sets (6, 60) cross each other with the adjustment angle  $\alpha$ .

34. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and on the circumference of the disc (47) alternately each with two tongs sets with k tongs each are provided and the tongs of a tongs set (6, 60) are located on a tongs line (61, 62) each and the tool magazine (4) can offer by means of rotating the disc (47) around the

adjustment angle alpha of the machining unit (3) a new set of tongs for changing or exchanging of tools.

35. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and the tongs (46) are guided and held in elongated holes (403) and therefore an adjustment is possible.
36. Machine tools according to claim 1 **characterised in that** the tool magazine (4) has a disc (47) which carries on its outside tool tongs (46) for picking up the tools (31) and tongs slabs (404) are provided which carry one or more tongs (46), respectively sets of tongs, the tongs slab (404) being able to be connected as a whole with the disc (47).
37. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a magazine door (44) which is open in the case of the tool change.
38. Machine tools according to claim 1, **characterised in that** the tool magazine (4) has a magazine door (44) which is open in the case of the tool change and the movement of opening the magazine door (44) is deviated from the movement of the tool magazine (4) on the supporting beam (10).
39. Machine tools for the in particular cutting machining of workpieces by means of a machining unit having at least one machining spindle, a tool magazine being provided which serves for supplying and changing the tools on the machining spindle, **characterised in that** the tool magazine (4) is held by a supporting beam (10) which penetrates the tool magazine (4).

40. Machine tools according to claim 1, **characterised in that** the tool magazine (4) is designed movably towards the machining spindles (3).
41. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) which extends essentially rectangular to the machining spindle.
42. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) which extends essentially parallel to the machining spindle.
43. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10), and the supporting beam (10) forms a crosshead between the columns, and the columns, on the other hand, have means for receiving the workpiece.
44. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10), and the tool magazine (4) has a supporting beam part (40) which can be put into the supporting beam (10).
45. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the tool magazine (4) has a recess (41) in the region of the penetration of the supporting beam (10).
46. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10), and the tool magazine (4) has a



motion drive (42), for example a working cylinder, which allows a movement of the tool magazine (4) essentially rectangular to the extension of the supporting beam using the recess (41).

47. Machine tools according to claim 1, **characterised in that** the tool magazine is held by a supporting beam (10), and the tool magazine (4) has a recess (41) in the region of the penetration of the supporting beam (10), and the tool magazine (4) has a guide (43) in the region of the recess (41) and the part (40) of the supporting beam can be moved sledge-like on the guide (43).

48. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the supporting beam (10) serves for strutting the tool magazine (4).

49. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the supporting beam (10) extends above the machining unit (2).

50. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the supporting beam (10) is essentially parallel to the spindle axis (30) of the machining spindle.

51. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the supporting beam (10) traverses the working room (13).

52. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and columns (11) connected with the machine tools bed (12) are provided which hold the supporting beam (10).
53. Machine tools according to claim 1, **characterised in that** the tool magazine (4) can be lowered vertically.
54. Machine tools according to claim 1, **characterised in that** the machine tools have at least two machining units with at least one machining spindle each.
55. Machine tools according to claim 1, **characterised in that** the different machining spindles work the workpiece from different sides.
56. Machine tools according to claim 1, **characterised in that** the tool magazine of the machine tools is held by a supporting beam (10) and the tool magazine (4) can traverse on the supporting beam (10).
57. Machine tools according to claim 1, **characterised in that** the tool magazine (4) serves for changing the tools (31) of the machining spindle of several machining units (2).
58. Machine tools according to claim 1, **characterised in that** the tools (31) in the tool magazine (4) are arranged in multiple rows.

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